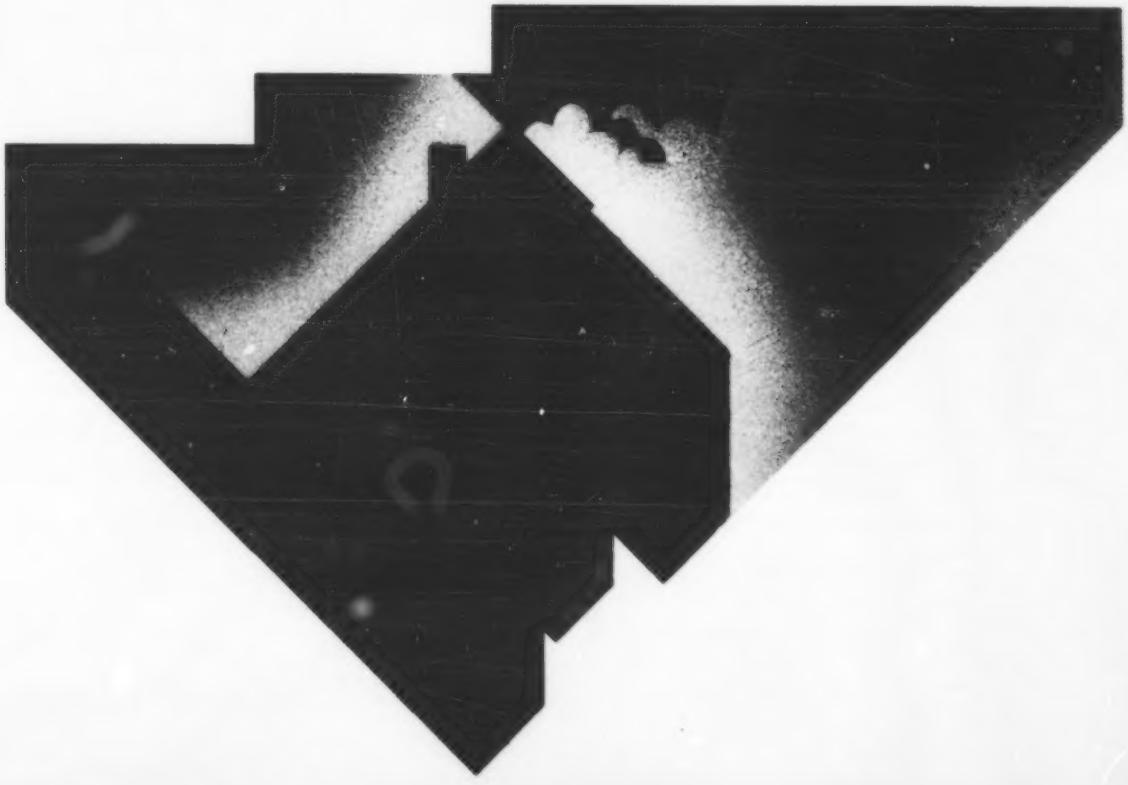
Nova Scotia
Energy
Strategy 1991
A Framework for Discussion
Efficiency
Environmental Quality
Security
Stability

Contents

3	1	**Introduction**
4	2	**Energy Supply and Demand**
6	3	**Goals and Guidelines**
9	4	**Strategy**
10		A Energy Efficiency and Conservation
12		B Electricity
13		C Coal
15		D Alternative Energy
17		E Oil and Gas
19	5	**Roles and Responsibilities**
21	6	**Where Do We Go From Here?**
23	7	**Conclusion**
25		**Appendices**



92-01620/

1 Introduction

There are few things that we consider to be as essential to our modern way of life as energy. Its availability and relatively low cost are important to our economy, comfort, and mobility. At the same time the supply and use of energy in its various forms can have a profound impact on our environment, our economic competitiveness, and even our national security.

The 1980s, particularly the last five years since Nova Scotia produced *Energy Plan 1985*, have seen dramatic changes that have affected energy production and use. Most significant among these have been:

- growing concern about our environment, particularly emissions from fossil fuel combustion;
- the instability of oil prices, which peaked at roughly $40 per barrel in the early 1980s, dropped sharply in the latter half of the decade, rose in response to the Iraqi invasion of Kuwait, and have again decreased;
- government deregulation of the energy sector;
- a rise of 7 per cent in primary energy use in Nova Scotia since 1984, following a steady decline that began in the late 1970s;
- the declining production of western Canadian conventional crude oil coupled with the increasing dependence of North America on oil imports, which has led to growing concerns about the security of oil supplies.

Governments at both the federal and provincial levels have a responsibility to work with the private sector to ensure adequate supplies of energy at stable and affordable prices, while maintaining the quality of our environment. This document sets out an energy strategy for Nova Scotia to achieve these broad objectives in view of the changes that have occurred in the past decade and that seem likely through the 1990s. This strategy is not intended to be a detailed plan that sets out all of the steps and initiatives that will be necessary. Rather, it is a framework to be built upon and establishes the goals and the basic strategy elements around which policies and programs will be developed.

In developing this strategy, the province has relied heavily on the views of the broad cross-section of Nova Scotians who participated in a two-day Nova Scotia Energy Strategy Roundtable held in November 1990. This input has been supplemented with information from a variety of other sources, including the energy sector of Voluntary Planning, the federal government, various provincial government departments, the Nova Scotia Power Corporation, and numerous studies and projects in which the Department of Natural Resources (formerly the Department of Mines and Energy) has participated. The strategy is based on a wide spectrum of views on how the province can best work towards its energy goals through this decade.

The next chapter provides an overview of how Nova Scotians consume energy, how it is supplied, and how this is expected to change over the next decade. Chapter 3 discusses the broad goals that the province would like to achieve, a number of policy guidelines that have helped to shape this energy strategy, and factors that may limit the success of the strategy. The fourth chapter presents the elements of the strategy as they relate to both the efficient use and the supply of energy in five policy areas: energy efficiency and conservation, electricity, coal, alternative energy, and oil and gas. The next two chapters deal with the roles and responsibilities of the general public, business, the energy industry, government, and regulators in working to attain Nova Scotia's energy goals and with how the province intends to achieve them.

Implementing the energy strategy will require a variety of specific actions, including policy development, design and undertaking of programs, further study in a number of areas, public information and education activities, research and development initiatives, and so on. This document sets out a framework for government action; subsequent documents will provide the specific policies and initiatives that will be adopted. Throughout this process, the government will continue to encourage public consultation and input.

2 Energy Supply and Demand

Energy Demand

In 1989 (see Table 1), Nova Scotia depended on imported oil and domestic coal for more than 90 per cent of its primary energy requirements. Imported oil accounted for 67.4 per cent of total energy demand, while coal represented 24 per cent. The remaining 8.6 per cent of demand was comprised of hydro-electricity (4.2 per cent) and wood (4.4 per cent). Other fuels such as solar energy and wind accounted for minor amounts.

Since 1985 when the last energy plan was completed, the proportions have changed little. In 1984 the shares were oil, 64 per cent; coal, 27 per cent; and hydroelectricity and wood, 9 per cent. The increase in oil demand over the subsequent five years resulted primarily from its low price throughout much of the period[1].

Our reliance on essentially two primary energy resources contrasts sharply with the nation as a whole. In Canada the comparable energy shares in 1984 were oil, 30 per cent; natural gas, 26 per cent; hydro, 26 per cent; coal, 10 per cent; nuclear, 7 per cent, and all others, 1 per cent. The major differences are the availability of natural gas in western and central Canada, nuclear power use in Ontario and New Brunswick, and the development of hydroelectric facilities on a scale that is not available in Nova Scotia.

Energy Supply

Of the four primary fuel sources used by Nova Scotians today, essentially only one originates outside the province (see Table 2). All coal and wood used in the province is produced in Nova Scotia. Our hydroelectricity (except for minor exchanges with New Brunswick) is also generated within the province. Only crude oil comes from outside Nova Scotia. In fact, all crude used in Nova Scotia refineries originates in foreign countries, primarily the United Kingdom. A more detailed discussion of Nova Scotia energy resources is provided in Appendix B.

Table 1

Primary Energy Demand in Nova Scotia, 1989 (Trillions of Btu)

Energy Source	Demand	Percentage of Total
For Sectoral Fuel		
Oil	142.4	57.3
Coal	1.7	0.7
Wood	10.9	4.4
Subtotal	155.0	62.4
For Electricity Generation		
Oil	25.2	10.1
Coal	57.9	23.3
Hydro	10.4	4.2
Subtotal	93.5	37.6
Total	**248.5**	**100.0**

Figure 1a

1989 Primary Energy Demand in Nova Scotia and Canada
(Percentage of Total Energy Demand)

Figure 1b

Primary Energy Demand in Nova Scotia (Trillions of Btu)

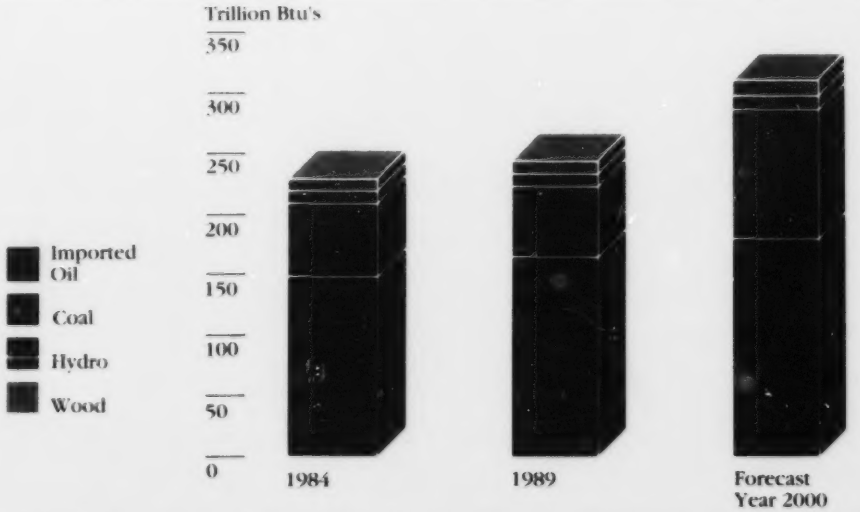


Table 2

1989 Primary Energy Demand in Nova Scotia and Canada
Relative Dependence on Imported Energy Supplies[2]
(Percentage of Total Energy Demand)

	Nova Scotia		Canada	
	Domestic	**Imported**	**Domestic**	**Imported**
Crude oil	0.0	100.0	68.0	32.0
Natural gas	N/A	N/A	98.5	1.5
Coal	100.0	0.0	64.9	35.1
Hydro/electrical interchanges	90.4	9.6	96.3	3.7
Nuclear	N/A	N/A	100.0	0.0
Others	100.0	0.0	100.0	0.0
All fuels	**30.2**	**69.8**	**85.5**	**14.5**

The heavy reliance on foreign oil means that two-thirds of our total energy supply is produced in foreign nations. In Canada as a whole, the comparable figure is only 14 per cent. The Atlantic region is more dependent on imported energy sources than any other region of the country.

Outlook

Given the existing structure of Nova Scotia energy use, estimates can be made of the components of energy demand by the turn of the century. Such forecasts rely on a wide array of assumptions about prices, economic growth, etc., so they are subject to a great deal of uncertainty. The forecast presented here shows where we might be headed given the best information available today and assuming no dramatic shifts in federal or provincial energy policy.[3]

In this forecast, primary energy demand will grow by about 2.3 per cent per year over the next decade, which will amount to a 28 per cent increase by the year 2000. Oil will continue to dominate demand, representing 58 per cent of total fuel use in 2000. Oil use is forecast to continue to grow, despite price and supply uncertainties. Growth is expected particularly in the commercial, industrial, and transportation sectors. This reflects the relative lack of substitutes for oil-based transportation fuels and the absence of natural gas as a competitor in the space and process heat market. Oil demand is expected to be fairly flat in the residential sector, as higher efficiency oil burners replace existing units and electricity continues to be used for new space heating requirements. The use of wood is forecast to increase for space and process heating requirements in the residential and industrial sectors.

Based on the assumptions underlying this forecast, coal demand will increase very significantly as base load electricity supply is expected to be derived primarily from coal-fired units over the next 10 years. There are a number of reasons for our continued reliance on coal. The remaining developable hydro sites in the province are capable of supplying only 1 per cent of the present electricity demand, so hydroelectricity production will increase only slightly. Large amounts of imported electricity from provinces such as New Brunswick and Quebec are not expected to be available within the next 10 years, because, without additional generating facilities, these provinces lack surplus capacity. Neither nuclear nor tidal power can be brought on line within a 10-year time frame. Natural gas from either western Canada or offshore Nova Scotia will probably not be available until near the end of the decade at the earliest, given the long lead times required for pipeline construction and offshore development. Coal therefore is Nova Scotia's primary choice for large-scale electricity generation over the medium term.

Actions can be taken to reduce the growth in energy demand that has been forecast, alter the mix of fuels and amount of each fuel used to meet that demand, and limit the environmental impacts associated with meeting our energy needs. The strategy presented in the rest of this document sets out the specific steps the province will take to ensure that our energy situation in the year 2000 is different than that in the forecast.

Table 3

Primary Energy Demand in Nova Scotia
Actual (1989) and Forecast (2000)[3] (Trillions of Btu)

Energy Source	Actual Demand (1989)	Forecast Demand (2000)	% of Demand in 2000	% Annual Change 1989-2000
For Sectoral Fuel				
Oil	142.4	163.9	51.4	1.3
Coal	1.7	2.4	0.8	3.2
Wood	10.9	12.4	3.9	1.2
Subtotal	155.0	178.7	56.1	1.3
For Electricity Generation[4]				
Oil	25.2	20.4	6.4	(1.9)
Coal	57.9	106.6	33.5	5.7
Hydro	10.4	11.6	3.6	1.0
Wood	0.0	1.3	0.4	N/A
Subtotal	93.5	139.9	43.9	3.7
Total	**248.5**	**318.6**	**100.0**	**2.3**

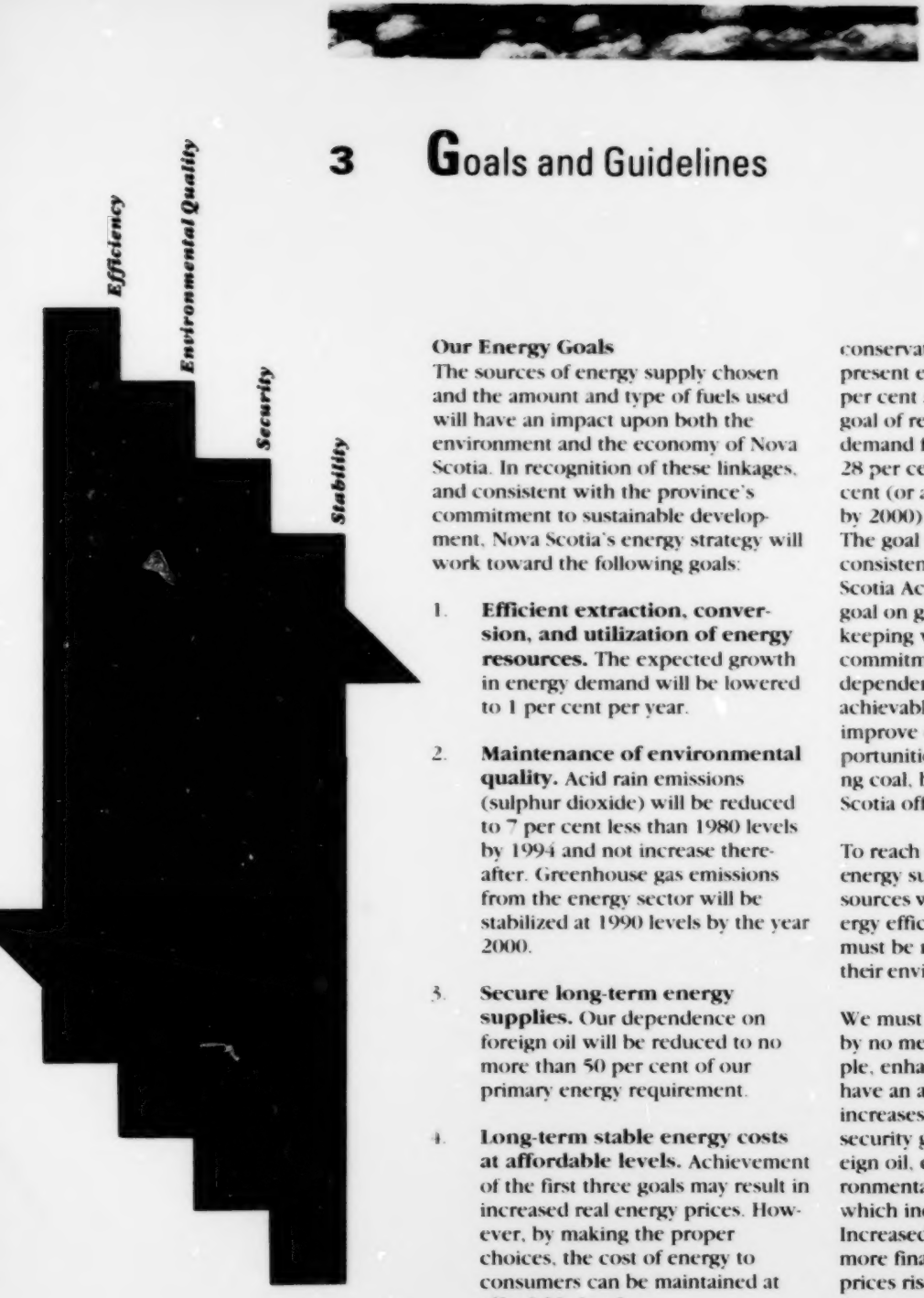
Notes

1. See Appendix A, which details how energy use in Nova Scotia has changed over the period from 1979 to 1989.

2. Canada is actually a net exporter of energy, meaning that it produces more energy than it consumes. However, due to the distance and cost of transporting energy from producing regions to Atlantic Canada, energy (mainly oil and gas) is exported from the west to closer markets in the United States, while eastern Canada imports much of its needs.

3. See Appendix C for the assumptions underlying this forecast.

4. This forecast was prepared in August 1990 and reflects a fuel mix resulting from only one of many possible fuel price forecasts.



3 Goals and Guidelines

Our Energy Goals

The sources of energy supply chosen and the amount and type of fuels used will have an impact upon both the environment and the economy of Nova Scotia. In recognition of these linkages, and consistent with the province's commitment to sustainable development, Nova Scotia's energy strategy will work toward the following goals:

1. **Efficient extraction, conversion, and utilization of energy resources.** The expected growth in energy demand will be lowered to 1 per cent per year.

2. **Maintenance of environmental quality.** Acid rain emissions (sulphur dioxide) will be reduced to 7 per cent less than 1980 levels by 1994 and not increase thereafter. Greenhouse gas emissions from the energy sector will be stabilized at 1990 levels by the year 2000.

3. **Secure long-term energy supplies.** Our dependence on foreign oil will be reduced to no more than 50 per cent of our primary energy requirement.

4. **Long-term stable energy costs at affordable levels.** Achievement of the first three goals may result in increased real energy prices. However, by making the proper choices, the cost of energy to consumers can be maintained at affordable levels.

These goals have been selected based on informed judgment of what is achievable. For example, based on work carried out for the Council of Provincial Energy Ministers as well as the work of many other organizations, we believe that cost-effective energy efficiency and conservation measures could reduce our present energy demand by between 10 per cent and 30 per cent. Therefore, the goal of reducing the growth in energy demand from 2.3 per cent per year (or a 28 per cent increase to 2000) to 1 per cent (or a total increase of 11.5 per cent by 2000) appears to be within reach. The goal related to acid rain emissions is consistent with the 1988 Canada–Nova Scotia Acid Rain agreement, while the goal on greenhouse gas emissions is in keeping with Canada's international commitments. The level set for dependence on foreign oil should be achievable given the potential to improve energy efficiency and the opportunities for fuel substitution, including coal, biomass, and possibly, Nova Scotia offshore oil and natural gas.

To reach these goals we must diversify energy supply sources, use indigenous resources where possible, and promote energy efficiency measures. Energy choices must be made with full consideration of their environmental implications.

We must recognize that these goals are by no means complementary. For example, enhanced environmental quality will have an associated cost and will lead to increases in energy prices. Similarly, our security goal, achieved by using less foreign oil, could have both cost and environmental implications, depending on which indigenous fuels displace oil. Increased energy efficiency becomes more financially attractive as energy prices rise; low prices reduce the attractiveness of efficiency improvements and can lead to greater energy use. There are apparent conflicts or tensions in simultaneously achieving all four goals. Resolving these to the extent possible will require compromise, sound judgment, and flexibility in the policies and initiatives that are implemented.

Energy, Environment, and Economy
Energy production and use affect both the economy and the environment of our province. Nova Scotia's energy strategy must achieve a balance between the availability of energy to meet the immediate and long-term demand, the environmental acceptability of energy production or supply choices, and the affordability of energy to a wide range of consumers. Bringing these three factors into one strategy requires compromise.

The production of indigenous energy sources can create jobs and supply some of our energy needs. Developing our supplies, however, may not be as financially or environmentally attractive as other supply options. Our industries must often compete in international markets where environmental standards may not be as strict as our own. Higher energy costs, which result from more stringent environmental standards, may affect our ability to compete. If we are to strengthen our economy and sustain the environment and resources upon which we depend, we must find a balance among all of our priorities.

Growth in the economy and efficient and environmentally responsible activities can go hand in hand. The use of energy-efficient technologies can create employment, reduce energy expenditures, improve competitiveness, and lessen environmental impacts. But more important, industries that are efficient and produce in an environmentally responsible manner will be the best equipped to compete in the global marketplace.

Policy Guidelines
In the development of the Nova Scotia energy strategy, certain underlying principles have been considered as given. They provide the guidelines within which the various strategy elements have been developed to form the overall strategy.The Energy Strategy Roundtable consultation process provided valuable input to the development of these principles, and they should therefore reflect the needs and values of the majority of Nova Scotians.

1. Energy should be produced and consumed efficiently. Conservation/efficiency should be considered as an alternative to energy supply.

2. Energy projects should be cost effective without the need for subsidies.

3. Energy consumers should pay the full cost of the energy products that they use.

4. Energy policy should be separate from, yet complementary to, social and economic policy.

5. All energy supply and demand options should be considered when analysing how best to meet our future energy needs.

6. Energy supply and demand projects must be judged according to their reliability, price stability, and environmental impacts, as well as cost and other economic considerations.

7. Energy activities must meet established environmental standards.

8. Energy users must be given complete and accurate information about their energy alternatives and an opportunity to participate in energy planning.

9. Government departments and crown corporations must cooperate in developing and implementing coordinated policies in all areas of responsibility.

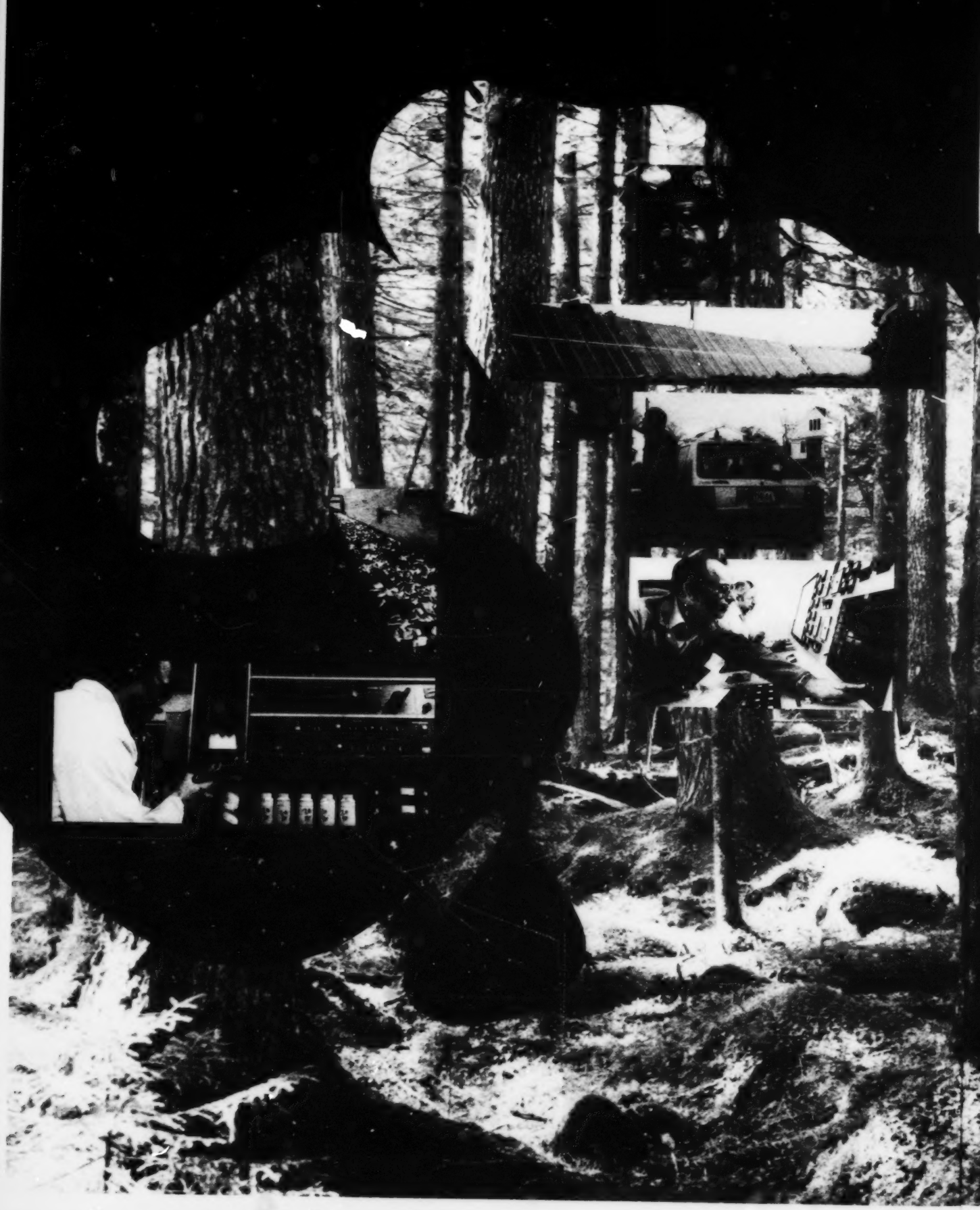
Limiting Factors
In developing an energy strategy, we must be aware that success in meeting our goals may be limited by a number of factors. Some factors are within the control of the provincial government, some can only be influenced by the government, and some arise outside the province's jurisdiction.

The rate of growth of overall energy use can be influenced by several means including the use of energy efficiency and conservation initiatives. While government and utilities can undertake programs that encourage efficient energy use, it is up to business and the public to adopt the measures that will bring about these efficiency improvements. The extent to which these measures are adopted will depend upon a combination of factors including energy prices, the cost of efficiency improvements, lifestyle preferences, and other priorities. Many of these factors are beyond government control.

Consumers will continue to choose the fuels they want to use. Government can only influence that selection, through the use of financial instruments, the provision of information, assistance with new technologies, and legislation.

The province also has only limited control over the availability of energy supply sources. Both the availability of energy from outside the province and the world price of many internationally traded commodities upon which we depend (most notably oil) are determined elsewhere. The province's role in this regard is primarily in the area of programs and activities to improve the security of energy supply.

Any efforts made by government to influence energy choices and energy markets must be considered carefully since policy measures usually have both positive and negative impacts. Energy policy is normally used to make adjustments and refinements to markets rather than to make large interventions or changes in direction.



4 Strategy

Introduction

This chapter presents the basic elements of the provincial energy strategy. These elements are the result of our comparing the province's goals, the forecast of where we believe we are presently headed, and the deficiencies or areas of opportunity that are identified. The strategy elements are consistent with the policy guidelines outlined in the previous chapter.

From the comparison between our goals and the forecast we can draw the following conclusions:

- In order to roughly halve the expected growth in energy demand of 2.3 per cent per annum over the next decade to our goal of 1 per cent, we must use energy more efficiently. A continued growth in demand of 2.3 per cent per year also raises concerns about environmental impacts as well as the need for greater expenditures for additional energy supplies.

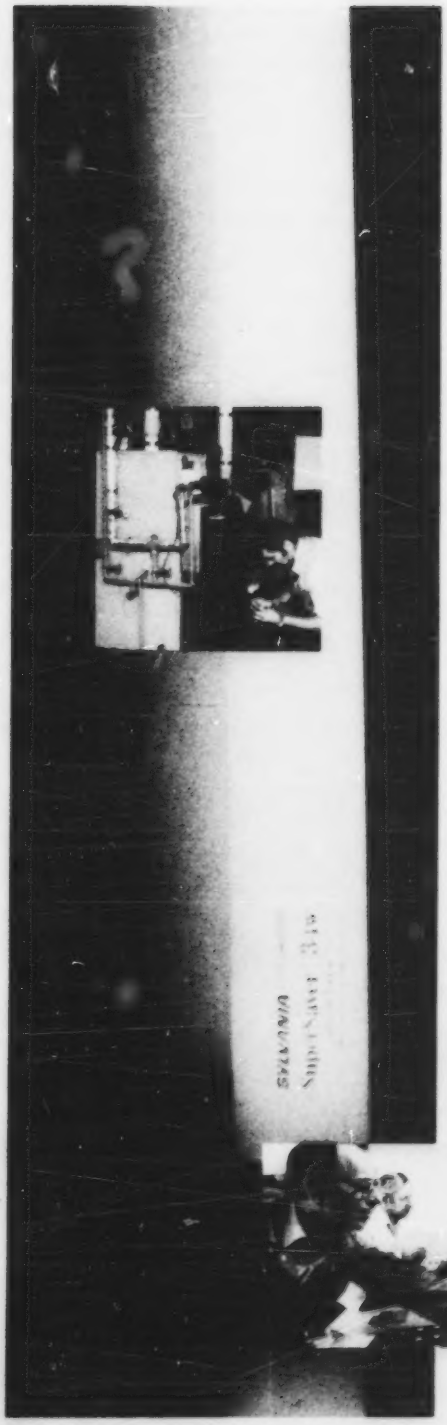
- Unless specific steps are taken, dependence on imported oil will remain high—roughly 60 per cent of our energy needs. Our goal of reducing this dependence to 50 per cent of primary energy supply by the year 2000 will improve the stability and affordability of energy prices and the security of our overall energy supplies.

- Greater dependence on indigenous energy sources, primarily through coal for electricity generation and wood for space and process heating will improve our long-term energy security and contribute to long-term stability. However, meeting our environmental goals will require us to develop and use clean coal technologies as well as pursue research and development in other areas.

The strategy elements that arise from these conclusions are outlined in the remainder of this chapter, arranged according to five policy areas: energy efficiency and conservation, electricity, coal, alternative energy, and oil and gas. These elements form the framework on which policies and specific activities will be built. Although different initiatives will be required for different fuel sources or applications, certain common elements can be found in the strategies for all of these policy areas:

- use of energy-efficient technologies
- diversification of supply sources
- use of indigenous resources
- maintaining the quality of our environment
- updating our legislation and regulatory framework where necessary
- use of better technologies and support of research and development
- improved public education and communication.

A Energy Efficiency and Conservation



Introduction

Energy efficiency implies minimizing waste in the production and use of energy. Conservation occurs when we reduce the need for energy. Replacing an inefficient furnace with one that uses less fuel to produce the same amount of heat illustrates energy efficiency; turning back the thermostat at night is conservation.

Energy efficiency and conservation now occupy a central role in the energy policy of industrialized economies. Their importance as tools for balancing energy supply and demand has risen with each new supply disruption or price rise. The natural decline in the availability of low-cost, nonrenewable fossil fuels coupled with a growing concern about the environmental impact of burning these fuels have also provided incentives for increased efficiency and greater conservation of energy.

Energy efficiency and conservation reduce the demand for energy and so represent an alternative to finding new energy supplies. Efficiency and conservation options are attractive because they can be implemented in small increments and tend to have a neutral or positive impact on the environment, unlike many energy supply projects. They may also be less costly than new supply projects.

Reducing our use of petroleum products will improve our energy security by reducing our need for imported crude oil. Conservation and energy efficiency can also help Nova Scotia improve the competitiveness of our goods and service industries, maintain and improve our standard of living, create jobs in the energy products and energy service industries, and reduce the environmental impacts associated with the development, production, distribution, and use of energy.

Background

Energy efficiency and conservation have contributed to the province's goal of maintaining stable supplies of energy at reasonable prices. Beginning in the mid 1970s, governments engaged in a range of energy-efficiency and conservation activities. These activities have focused on energy efficiency in all sectors of the economy with emphasis on cost-effective, proven technologies available in the marketplace. Together, these initiatives have heightened the awareness of Nova Scotians about the benefits of energy efficiency and provided a solid base for future initiatives.

Between 1984 and 1989, the province used 6 per cent less energy per unit of economic output. However, in spite of significant improvement, Nova Scotia, and Canada as a whole, have not reached the level of increased efficiency achieved in some other major industrialized countries. Canadians, due in part to climate and geography, continue to be among the highest energy users per capita of any country.

Without these gains in energy efficiency and conservation, energy supplies would be tighter and prices higher than they are today But, as a province and a country, considerable potential still exists to improve our energy efficiency.

Current opportunities for improving the efficiency of energy use are substantial—national estimates range from 10 to 30 per cent of current consumption,

depending on sector, energy price assumptions, and financial criteria. Gains in energy efficiency will occur as old equipment, vehicles, and buildings are replaced with new, more efficient ones. Government can play an important role in influencing how quickly these gains occur, how far reaching they are, and whether the improvements in efficiency are as large as they could be.

In each of the sectors—residential, transportation, industrial/agriculture, and commercial/institutional—there is a diverse range of barriers to energy efficiency and conservation improvements. Low energy prices are the most important reason why energy consumers have not implemented cost-effective energy-efficiency improvements in recent years. Concern over using new or unproven technologies and lack of suppliers of energy-efficient equipment have also been barriers. These factors, and the perception held by some that energy prices and supply are not significant issues, appear to have contributed to some consumer and business indifference to reducing energy consumption.

One other key area that must be addressed relates to public information and increased awareness. While the public overwhelmingly supports conservation and energy efficiency measures to enhance environmental quality, they often do not recognize the collective impact of individual actions. This relationship between energy use, energy projects, and environmental costs must be strengthened in the public mind.

Government has a range of options for overcoming the barriers to increased energy efficiency and conservation. These options include information programs, financial incentives, taxes, regulation, and research and development. Government must also practise energy efficiency and conservation within its own operations and areas within its overall control.

Strategy for Energy Efficiency and Conservation

1. ***Education, public information, and training will play key roles as government takes action to ensure that energy consumers have a better knowledge of energy efficiency.***

   Efforts will be directed at providing information on the benefits of and opportunities for energy efficiency and conservation. The training needs of those in professions and trades that have a direct influence over energy demand will also be addressed, and tomorrow's energy consumers will be reached through the public school system.

2. ***The province will set an example by emphasizing energy efficiency and conservation in its overall operations, particularly in government-funded facilities.***

   The government will continue to act upon cost-effective opportunities for energy efficiency and conservation to reduce energy costs in government-funded facilities. Energy efficiency in operations and cost-effective energy retrofits will be increased to demonstrate to all Nova Scotians the many opportunities for improvements. New government-funded facilities will incorporate energy-efficient design, equipment, and construction practices and will serve as examples to the private sector of energy options in new construction. Energy efficiency will also be given increased priority in the purchase of new government vehicles and equipment.

3. ***The province will promote demonstration and information transfer activities that encourage cost-effective technologies suitable to Nova Scotia.***

   Technical and financial support for selected demonstrations of energy efficiency and conservation technologies will help provide homeowners, business, and industry with the information they require to evaluate new technologies.

4. ***The province will selectively use standards and regulations to improve energy efficiency. Areas of emphasis will be the design and construction of new buildings and the sale and leasing of energy-consuming products such as major household appliances. The federal government will be encouraged to upgrade fuel efficiency guidelines for new vehicles.***

   Capital expenditure decisions are unfortunately often based on a lowest first cost. This frequently results in the acquisition of equipment that is not very energy efficient and leads to excessive energy use during the service life of new buildings, equipment, and vehicles. Standards and regulations, when properly applied, help overcome this problem.

5. ***The province will examine new ways, such as innovative financing of energy retrofits and technical advice on saving energy, to help the general public control energy costs. Particular attention will be paid to groups experiencing difficulties meeting their energy bills such as low income consumers and senior citizens.***

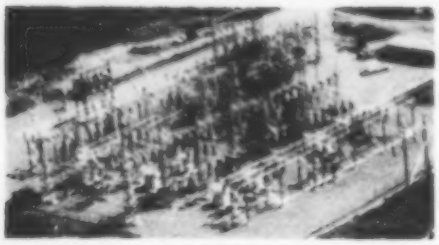
   These actions will help overcome such barriers as availability of capital and reluctance to use new or unproven technologies. Although energy efficiency and conservation can help ensure access to affordable energy supplies for all groups, low and fixed-income groups may require special assistance with improvements to reduce their energy use.

6. ***Provincial policy will reflect the importance of energy and environmental issues and their links with energy efficiency.***

   Nova Scotians are increasingly aware of energy efficiency and concerned about environmental quality. Energy efficiency and conservation can enhance environmental quality by reducing energy use. It will be one of the primary elements of Nova Scotia's strategy for addressing global warming.

   Because of environmental benefits, energy efficiency and conservation will be given full consideration in the selection of options for addressing the future supply and demand for energy in Nova Scotia.

B Electricity



Introduction

Most of the electricity consumed in Nova Scotia is generated in the province using domestic fuels (coal and hydro power). About 95 per cent of the generation is produced and distributed by a provincial crown corporation, the Nova Scotia Power Corporation (NSPC). Most activities of the Nova Scotia Power Corporation and the other small municipal utilities are directly regulated by the Board of Commissioners of Public Utilities (PUB). Decisions made by the PUB control almost all aspects, from the setting of rates to the construction of new facilities. As a result, given the present structure of electricity production, distribution and regulation, the government can provide a significant degree of policy direction.

Background

The demand for electricity will continue to grow, relative to other end-use energy sources, as electricity will be a preferred fuel for many applications. This trend will be accelerated as we move towards a more information- and service-oriented economy. Electricity will also continue to be used for residential and commercial space heating, while it is the only option for lighting and most appliances. More widespread applications of electrotechnologies to industrial processes will also contribute to an increased use of electricity.

Increasingly, utilities in North America are providing programs to reduce the growth in electricity demand and electrical energy use through demand side management (DSM) initiatives. Typical DSM measures are replacing incandescent lights with lower wattage fluorescents, using high efficiency motors, installing load controllers to limit peak electricity demand, and insulating electric water heaters. Such initiatives not only lower the amount of electric energy used, but also reduce the amount of generating capacity required to meet peak demand. While opportunities for DSM and efficiency improvements exist, they will not be sufficient to offset completely the expected growth in electricity demand. These measures can delay the need for new sources of electric power in the future, but they cannot eliminate it.

While the importance of energy costs to the viability of a business varies according to the energy intensity of the particular business, electricity rates will play a crucial role in determining the competitiveness of energy-intensive Nova Scotia industries, such as pulp and paper plants and steel mills, in international markets. Electricity rates will also influence our ability to attract new industries to the province.

Increasingly, electricity generation options will be constrained by provincial emission standards, which in some cases will be tied to national and international agreements. Given existing technology and the environmental controls on new plants, adding new generation capacity to the system will almost certainly result in an increase in the cost of generating power and hence an increase in power rates.

Strategy for Electricity

1. ***Growth in peak demand and electric energy use will be minimized through the use of cost-effective demand side management programs that promote energy-efficient technologies and practices.***

   Use of cost-effective measures could postpone the need for new generation facilities and hence help ease long-term upward pressure on power rates. They will also contribute to reduced emissions by lowering fuel use for electricity production.

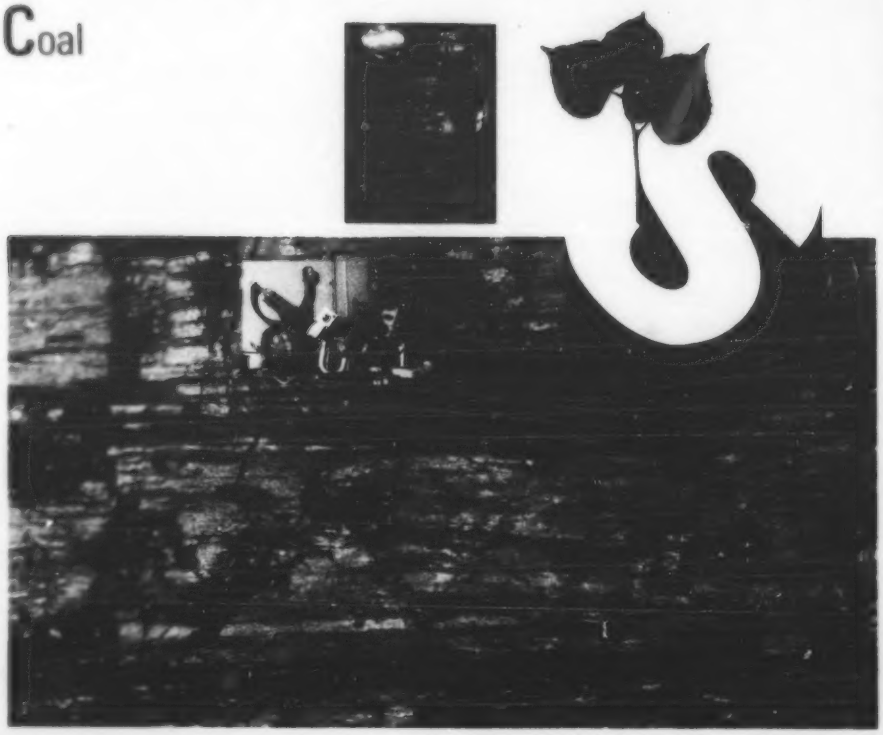
2. ***In the short and medium term, the province will continue to rely on coal-fired electricity from existing and committed generation facilities.***

   This makes sense from the point of view of capital already committed to power plants, as well as the stable fuel pricing and security benefits of using an indigenous fuel.

3. ***All alternative sources of electricity supply will be assessed on a case-by-case basis when new supplies are required.***

   Cost-effectiveness, reliability, price stability, and environmental impacts are the primary selection criteria employed. Power import

c Coal



opportunities will be explored and compared to the costs of expanding generation capacity in Nova Scotia.

4. ***The maximum price paid by a utility for alternative sources of power (from independent power producers) will be based on the full avoided costs of generating power on the utility's system.***

   If support for independent generators is judged to be warranted for social or economic development reasons, such support should not be through buy-back rates that exceed the full avoided costs. The avoided costs must include all costs required to meet environmental standards. The electricity consumer will pay the full cost of the electricity, but will not bear the additional costs associated with other objectives.

5. ***All energy projects will be treated consistently within the established regulatory framework.***

   In consultation with others, government's role is to establish provincial energy policy. Within that policy framework, regulators will be expected to apply the regulations consistently and fairly across all utilities and all applications, including export projects.

6. ***Better information on the regulatory process will be provided to the public, and means to enable public input at regulatory proceedings will be examined.***

   Regulatory bodies should take care to ensure that the public better understands and has access to the regulatory process. Methods to support intervenors before regulatory bodies will be investigated.

Introduction

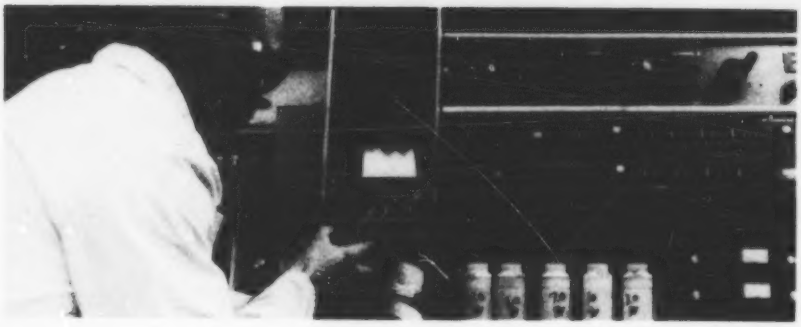
It is unlikely that much of the world, including Canada, will be able to meet medium-term energy requirements without using coal in some form. In Nova Scotia, coal is expected to remain the dominant fuel source for electricity generation for at least the next 10 years, because, unlike other provinces, we do not have natural gas, nuclear power, or significant additional hydroelectric power readily available to us.

In 1989 sales of Nova Scotia coal exceeded $196 million, and approximately 3,200 people were directly employed in the coal industry. While our considerable reserves of indigenous coal offer the advantages of providing price stability, security of supply, and employment, the disadvantages include the environmental impacts of combustion emissions. We must therefore use research and development to make technologies available that will reduce the contribution to acid rain and greenhouse gas emissions caused by burning coal. These are often referred to as clean coal technologies.

Background

The impact on the environment remains the biggest concern over the use of coal as an energy source although other fuels present similar problems to varying degrees. Nova Scotia is bound by the 1988 Canada–Nova Scotia Acid Rain Agreement, which commits the province to reducing sulphur dioxide emissions from 1980 levels by about 7 per cent by 1994. Follow-on agreements will no doubt seek to reduce emissions even further, notwithstanding the fact that more power plants will be required as demand for electricity grows. In the meantime, the Nova Scotia Power Corporation's twin strategies of using low sulphur coal from Westray Coal's new Pictou County mine for units 5 and 6 of the Trenton power plant and employing circulating fluidized bed technology for the new Point Aconi power plant will see that the 1994 target is met. After 1994, any further reductions in emissions causing acid rain will have to be accomplished by the use of new technologies at existing plants or by building new technology plants.

The global warming issue continues to receive considerable attention, although there is some disagreement within the scientific community about its primary cause, its timing, and its eventual im-



pact. Canada has made international commitments towards limiting emissions of greenhouse gases by agreeing to work towards the stabilization of carbon dioxide and other greenhouse gases at 1990 levels by the year 2000. Since coal-fired power plants emit carbon dioxide and other greenhouse gases, coal use will clearly be affected by these commitments.

Strategy for Coal

1. ***Action will be taken to reduce emissions from coal-fired power plants.***

   As mentioned in the goals, a target for acid rain emissions has been set for 1994 and a strategy developed to meet that target. Targets for reductions beyond 1994 will be a matter for agreement between the provincial and federal governments. Further reductions are possible but, because of the technologies involved, will be expensive.

   Reductions in greenhouse gases like carbon dioxide (CO_2) are much more difficult and expensive to achieve. Despite the scientific uncertainty about the extent and impact of global warming, the stabilization of greenhouse gas emissions at 1990 levels by the year 2000 is a provincial goal. The province's strategy to meet this goal has been developed and includes steps to reduce emissions from coal-fired power plants.

   The province will encourage further steps to improve the overall efficiency of power production such as using more efficient combustion processes in new plants, retrofitting older plants, cogeneration, or using waste heat in viable district heating applications, since these will have the effect of reducing emissions per unit of energy produced.

2. ***The province will help fund coal research, development, and demonstration projects.***

   To ensure that our coal is used in an environmentally responsible manner, it is essential that more emphasis be placed on research, development, and demonstration specific to Nova Scotia coals. Coal liquefaction and integrated coal gasification combined cycle technology are examples of new technologies that must be examined to determine their applicability to Nova Scotia coals. Much of the future of the coal industry in Nova Scotia will depend upon the results of research programs currently under way or in the planning stage.

3. ***The province will investigate funding strategies for coal research and development and implement the most promising.***

   Although some clean coal research is already undertaken in the province, ways of funding the more extensive research on Nova Scotia coals now needed are currently under consideration by the province, industry, and the federal government. Cost-sharing by the various participants, either through direct annual contributions or by increases in coal royalties, are the options under consideration. Any increase in coal royalties would be passed on to the coal purchasers, such as NSPC, who in their case would pass it on to electricity consumers. The monies involved are relatively small and would result in an almost negligible increase in power rates.

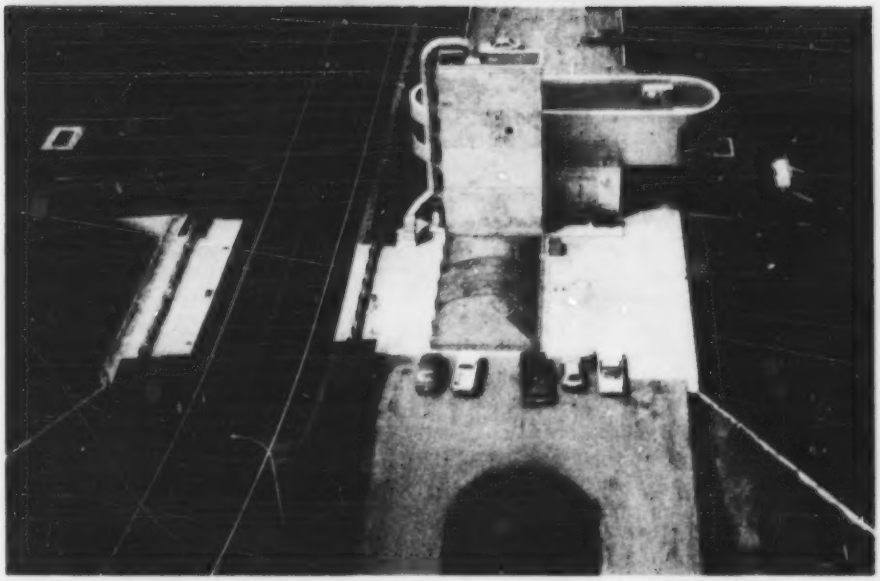
4. ***The province will encourage exploration for and development of our coal resources.***

   Since forecasts show that Nova Scotia will need additional coal to meet future demands for electricity, exploration for and development of our coal resources will be encouraged. The pace of development should be dictated by demand for coal and coal products from provincial and export markets. No new subsidies from the province to the private sector will be made to produce coal, and only those companies or organizations having the technical expertise and the financial capability will be considered for coal exploration licenses and mining leases. Coal exploration and development programs must comply with all environmental regulations.

5. ***Better information on coal will be provided to the general public.***

   Steps will be taken to ensure that the general public is better informed about the province's coal supply, development and use.This will include the new clean coal technologies under development. The public will also be made aware of the economic potential of Nova Scotia's large coal resources. A better informed public should result in better decisions being made when new projects and/or programs are being planned or implemented.

D Alternative Energy



Introduction
Alternative energy includes renewable energy from biomass, solar (passive, active, and photovoltaics), wind, hydro, and tidal energy as well as energy from waste incinerators, nuclear energy, geothermal energy, and alternative transportation fuels such as natural gas, propane, and alcohols or alcohol fuel blends. Using alternative energy will reduce our dependence on imported oil, generally lower energy operating costs, and diversify our energy mix. Alternative energy sources tend to be more secure and, in many cases, have less negative impact on the environment than most conventional energy sources.

Background
Alternative energy in one form or another supplied much of Nova Scotia's early energy needs. The importance of alternative energy diminished as more inexpensive and convenient sources of energy became available. Interest was rekindled during the energy price shocks that began in the mid 1970s and resulted in major government programs to develop and support the commercialization of new alternative energy technologies.

Areas that have received the greatest attention include biomass combustion, large scale tidal development, and solar energy. The results in Nova Scotia have included the installation of more than 20 industrial and institutional wood energy heating plants, the construction of a 19.5 megawatt prototype tidal generation plant at Annapolis Royal, and a relatively large number of passive and active solar applications.

Much of the technology developed as a result of these programs has proven to be reliable and functional. However, with the exception of wood energy, passive solar energy, some active solar applications, and projects in remote areas where conventional energy sources are very expensive, many renewable energy technologies still have lengthy payback periods at current energy prices. On the other hand, most alternative technologies have a favourable impact on the environment, a positive economic impact on local economies, and a particular application or "niche" where they are most cost effective.

Many alternative energy technologies, such as solar, hydro, and wind, have very low operating costs but high initial equipment prices. Decision makers who require short paybacks (common in the industrial sector) are unlikely to invest in alternative energy technologies. Residential, institutional, and some commercial users who are willing to recover investments over a longer time frame are more likely to adopt these technologies.

Typically, alternative technologies do not meet commercial or market criteria. However, another aspect of determining cost effectiveness from an economic or societal point of view is the concept of full cost accounting. Many renewable energy technologies may be cost effective when societal benefits, the cost of environmental damage, and the value of subsidies or tax concessions enjoyed by a particular technology are included in the calculation to arrive at its "real cost." A great deal of work remains before these factors can properly be integrated into the decision-making processes.

The limited financial resources available to government make it crucial that a strategy be carefully planned to focus on technologies with a good potential market that are either financially sound now or show promise to be in the near future.

Strategy for Alternative Energy

1. ***The province will evaluate the suitability, performance, and cost effectiveness of alternative energy technologies.***

   New technologies will develop and technical innovations in older technologies will occur in the future. Government will monitor and periodically review new and developing alternative energy technologies to identify developments that may have application in Nova Scotia. Past experience suggests that sources with the greatest potential include wood, passive solar, small hydro, and tidal.

2. ***The province will implement cost-effective and technically sound technologies in government facilities.***

   Government must lead by example and invest in cost-effective alternative technology for publicly owned or funded facilities. This should reduce facility operating costs and provide demonstration sites with a high level of community exposure. An example of this is the conversion of large government facilities to wood energy.

3. ***The province will assist with the demonstration of underused technologies.***

   Technologies that are new to or underused in Nova Scotia and that also have replication potential will be demonstrated at suitable sites. This will allow potential users to assess the technology's performance in a Nova Scotia setting. Assistance may include technical support, cost sharing, and information dissemination.

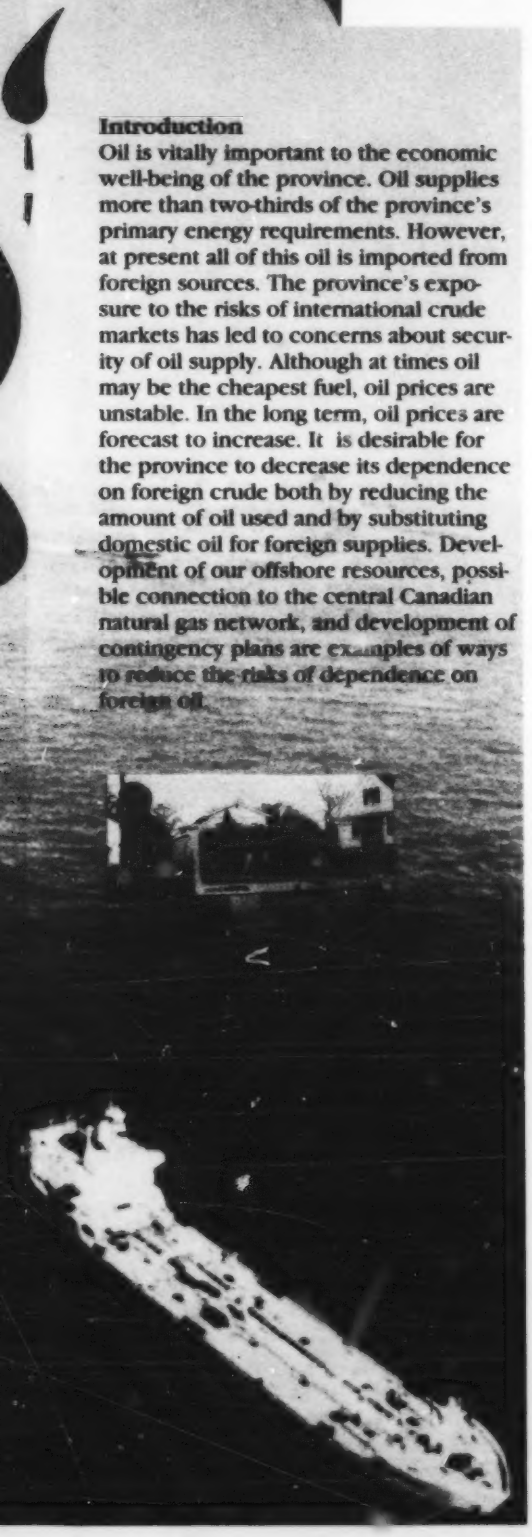
4. ***The province will develop initiatives to inform potential users and the public about promising new alternative energy technologies.***

   Information programs, seminars, public events, and other forms of technology transfer are effective ways to inform potential users about the benefits of new technologies and how they can be applied to specific end uses. Publication of information on specific technologies, the results of demonstrations and monitoring projects can foster replication and help avoid the repetition of mistakes. Information programs are especially important for technologies like passive solar energy, which can be designed into many residential and light commercial buildings at minimal cost.

5. ***The province will continue to identify, analyse, and work to overcome barriers to proven and promising alternative energy technologies.***

   These barriers or difficulties may prevent promising alternative energy technologies from achieving a greater share of the market. Identifying barriers is the first step towards designing programs or initiatives that correct or overcome these problems.

E Oil and Gas



Introduction

Oil is vitally important to the economic well-being of the province. Oil supplies more than two-thirds of the province's primary energy requirements. However, at present all of this oil is imported from foreign sources. The province's exposure to the risks of international crude markets has led to concerns about security of oil supply. Although at times oil may be the cheapest fuel, oil prices are unstable. In the long term, oil prices are forecast to increase. It is desirable for the province to decrease its dependence on foreign crude both by reducing the amount of oil used and by substituting domestic oil for foreign supplies. Development of our offshore resources, possible connection to the central Canadian natural gas network, and development of contingency plans are examples of ways to reduce the risks of dependence on foreign oil.

Background

The offshore region of Nova Scotia contains commercial quantities of oil and significant gas reserves with the potential for additional discoveries in the future. Offshore exploration and development could help to lessen Nova Scotia's reliance on foreign sources of oil. However, such activity must proceed only with due safeguards for the environment and the fishing industry.

The Cohasset-Panuke project, a joint undertaking by LASMO Nova Scotia Ltd. and Nova Scotia Resources Ltd, will be the first commercial offshore production project in Canada. The project will produce about 35 million barrels of light crude oil over its six-year life. It is anticipated that this project will be a catalyst for renewed exploration and further development of Nova Scotia petroleum.

Over five trillion cubic feet of natural gas have been discovered in the offshore area. However, the cost of developing these reserves is high, and a successful offshore gas project will require a large immediate market, which is not currently available in the Maritime provinces. So far, the economics of a gas project have been unfavourable. New technologies that can reduce the cost of producing offshore gas, higher oil and gas prices, and developments in gas transportation infrastructure could change the economics significantly in the future.

Nova Scotia also has potential for the discovery and development of onshore petroleum resources. Some exploration activity has taken place over a number of years and in spite of several petroleum shows, no significant discoveries have been made to date. Attention is also beginning to be given to the province's reserves of coalbed methane, a resource very similar to natural gas.

In the "downstream" end of the oil industry, recent amendments to the Gasoline and Fuel Oil Licensing Act have led to changes in the way in which wholesalers and retailers market their products. Most facility and entry controls for retailers have been removed and prices are no longer regulated; self-serve stations are now permitted. Regulation of the industry to ensure safety has been enhanced. The industry and consumers are slowly adjusting to the new regime, which over the long term should lead to increased competition.

Strategy for Oil and Gas

1. ***The exploration and development of our onshore and offshore oil and gas resources will be encouraged.***

   The province's role will involve technical and economic assessment of our oil and natural gas resources, including the review of possible development alternatives and markets. In a climate of uncertain oil prices, the large, secure supply of natural gas from our offshore area remains an appealing development prospect. Exports will be considered where an export market is necessary for project viability.

   The Department of Natural Resources is responsible for setting and administering the royalty structure for production from petroleum projects. A royalty regime that is sensitive to the high capital costs of development but allows Nova Scotia a fair return from the resource can have a considerable impact on the timing and nature of development projects.

   The province also has petroleum exploration potential onshore. Several onshore wells have been drilled with encouraging shows, but as yet hydrocarbons have not been discovered in commercial quantities. Initiatives are under way to more fully evaluate and promote these resources, and these will be continued. A new

area for onshore petroleum assessment is the province's coalbed methane reserves. The province has large indigenous deposits of coal that can be tapped for their gas, while at the same time making future mining of the coal reserves a safer operation. Work will be undertaken to more fully evaluate this resource and its development potential.

2. ***Opportunities to use and market natural gas will be evaluated.***

Access to natural gas would improve Nova Scotia's energy supply diversity, enhance energy security, and provide environmental benefits. Gas supply options include extending the Trans Quebec and Maritimes (TQM) pipeline from Quebec into Nova Scotia or developing our offshore natural gas resources to supply the Maritime provinces market and perhaps beyond. Market opportunities will be studied and supply options for the Maritimes evaluated. If the TQM line is extended, Nova Scotia will seek to have a reversible pipeline constructed to permit the east-west flow of Scotian Shelf gas to markets when development takes place.

3. ***Protection of the environment and prevention of oil spills and other accidents will continue as top priorities.***

This is already a requirement for the regulatory approval of oil and gas projects and for transportation of oil and gas from any source. However, emergency response measures that would apply in the event of accidents will be continuously reviewed and updated.

LASMO's recent submission of an Emergency Response Contingency Plan for the Cohasset-Panuke project is an example of the strict regulatory requirements for oil and gas projects.

Care will be taken that offshore oil and gas development does not harm Nova Scotia's important fishing industry. Cooperation between the two industries can be achieved only by extensive dialogue and sharing of information.

4. ***Contingency measures, including tactical crude oil storage, will be pursued to enhance the security of our oil supply.***

The province's total reliance on foreign sources of oil remains a major concern. Recognizing that it is not realistic to expect a complete elimination of our reliance on foreign oil supplies (due to limited domestic resources, refining and transportation constraints, continued requirements for oil as a transportation fuel), it is prudent to develop contingency plans to deal with a supply disruption. These include preparation of a comprehensive plan for demand restraint programs that complement federal and international emergency sharing systems. As well, the development of a tactical crude oil reserve of about two million barrels to be used to supply the Atlantic region during a shortage situation should be pursued. Efforts will include assessing alternative means of financing such a facility, and identifying and costing various potential sites for the storage.

5. ***Monitoring of the downstream oil industry in Nova Scotia (wholesale and retail gasoline and fuel oil marketing and pricing practices) will be undertaken.***

Specifically, prices of gasoline and diesel and furnace oil will be surveyed and the results made public on a regular basis. Other aspects, including the level of competition resulting from the changes and the impact on consumers in terms of service, convenience, and costs, will be the subjects of regular, ongoing evaluations.

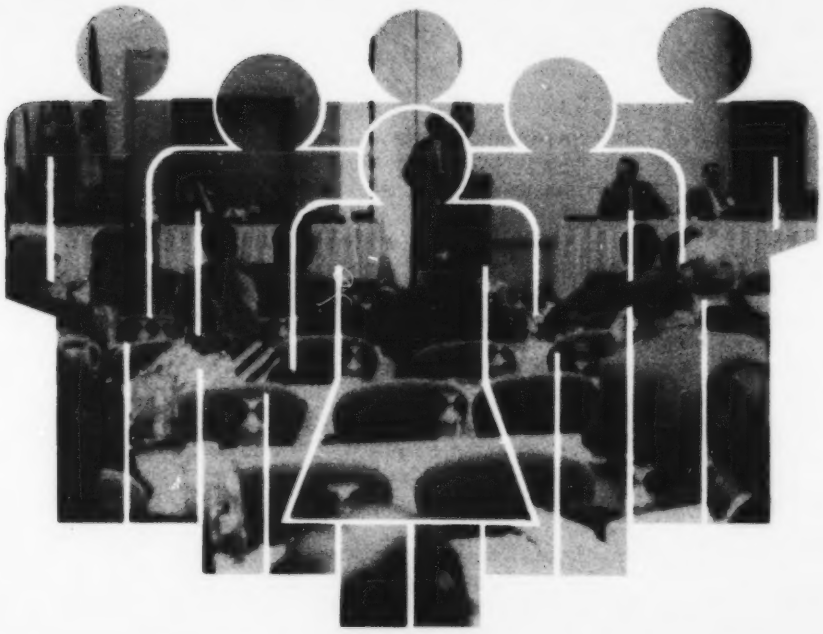
6. ***Increased efforts will be made to educate the general public about Nova Scotia's oil industry and to promote exploration for and development of our petroleum resources.***

It is important that information be provided to the public on efficiency of oil use, particularly in the transportation sector, as well as on financially viable alternatives to oil. Information should also include how oil products are priced and the factors influencing these prices, the alternatives available, and the costs (including environmental) of these various energy alternatives. Publications and initiatives will be developed to ensure that this information is made available.

Information also will be provided concerning the potential of Nova Scotia's petroleum resources, the ways in which they could be developed, the economics of projects, the impacts of these projects on the local economy, and the benefits and opportunities of resource development.

Several publications will be produced on the province's petroleum industry and resources: first, a document for the general public on Nova Scotia's oil and gas potential and activity; second, a pamphlet of informational and promotional material for general distribution at trade shows and when requested by industry; third, a publication designed to promote exploration of the province's onshore resources to the industry.

5 Roles and Responsibilities



The foregoing discussion has outlined the key elements of an energy strategy for Nova Scotia. Many of these strategy elements resulted from the Energy Strategy Roundtable discussions. A large number of these strategy components also reflect recent policies of the government and concerns of the public.

The Energy Strategy Roundtable discussions highlighted the need for a concerted effort by all participants if we are to realize our energy goals. In effect, energy consumers and those responsible for ensuring its supply, including government, must become partners in making the changes necessary to carry us into the next century.

The Public

The public stands out as having the most critical role in establishing the future direction of energy supply and use in Nova Scotia. One responsibility of the public is to become more involved in the energy policy formulation process.

The public must first gain a greater awareness and understanding of the province's energy situation and energy options, as well as the individual's own options and choices and the implications of each one of these choices. People must take this information from various sources and then provide feedback to government so that policy makers can determine what options are preferred.

The second responsibility of the individual is to use our limited energy resources in a more efficient and responsible manner than has been the case to date. Whether through using fuels that are less environmentally harmful, conserving energy, or substituting for oil products, each individual has an important role to play if we are to realize our energy goals.

Business

The business sector, as the largest consumer of energy in the province, has a significant role to play in defining our energy future. While large strides have been made in improving energy efficiency in the industrial and commercial sectors, much remains to be done. Although energy expenditures vary markedly from firm to firm, efficiency measures still offer sizeable cost-reduction opportunities for most operations.

Business must become better informed of methods of using energy more wisely. Demonstrated, cost-effective energy-efficient technologies should be understood and adopted wherever appropriate. Business must also support and pursue research and development opportunities and initiatives where there is a market need for the results.

Businesses have an obligation to behave as good corporate citizens in their utilization of energy. The media and public often look to the corporate sector for leadership. Thus they must lead in their adherence to environmental requirements, safety standards, and other government regulations related to the myriad of energy applications in the workplace.

Energy Industry
The energy industry has responsibilities over and above those of the broader business sector. The industry appears to bear the brunt of media and public attention whenever an unusual price escalation occurs. Since this criticism is not always fair, it indicates the need for the industry to better inform the public of the industry's role in the overall energy supply system.

The industry also shares with government the responsibility to plan and implement measures that will ensure adequate supplies of energy even in times of crisis. While it is probably impossible and certainly not cost efficient to prepare for all contingencies, prudent preparations to overcome most eventualities can be made at relatively low cost to society.

Government
Government's role is to establish the general framework and process through which a comprehensive and efficient energy policy can be attained. This includes setting the basic goals and strategies in order to focus the public debate, establishing targets and standards related to energy production and use (environmental, efficiency, safety, etc.), and putting programs in place to effect policy objectives.

Government must make expanded education and information available to all, so that they are fully informed of the ways energy can be used more efficiently, the energy resource base in Nova Scotia, our options for future energy supply, and what each of these choices means to both the individual consumer and the province as a whole.

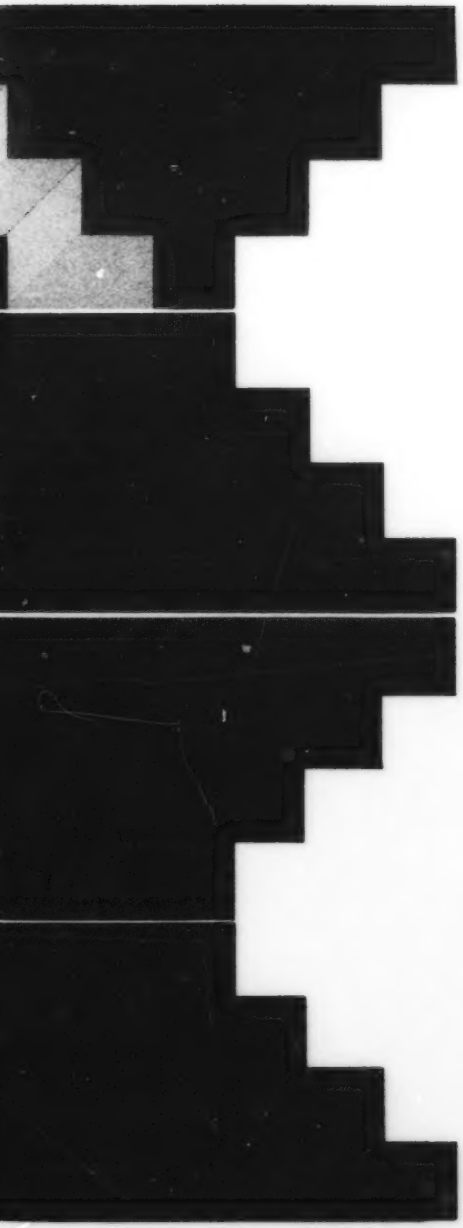
The public will be consulted about new policies when they are being formulated. This will be achieved in a number of ways including encouraging public access to the regulatory process. The results of this public consultation will be incorporated into policies that are both compatible with the other economic and social policies of the government and coordinated with the actions of other governments and industry.

Lastly, government will take steps to ensure that energy consumers and producers have the tools they require to meet the energy challenges ahead. This includes information on and demonstration of new and promising technologies. As well, a consensus must be reached with other governments and industry in establishing research and development priorities and encouraging selected initiatives.

Regulators
The Nova Scotia regulatory framework was identified by the Roundtable participants as an important ingredient in many of the most basic energy policies and decisions made in the province. The primary responsibility of regulators is to administer the regulations set out by the government. Yet their roles and responsibilities are not well understood by many members of the public.

All regulatory authorities must undertake a more active public information effort. This includes explaining the regulatory process to the public, providing an atmosphere receptive to public input into their decisions, and being clearly accountable for their actions and decisions. Regulators must also monitor the impact of the regulations that they administer and provide feedback to the government in the form of recommendations regarding the appropriateness of the regulations.

6 Where Do We Go From Here?



Release of this Energy Strategy document marks the third major component of the strategy development process. The first was the compilation of an energy discussion document for participants in the Energy Strategy Roundtable that outlined background information on Nova Scotia energy markets and listed the major issues facing us today. The second stage involved the convening of the Roundtable and the release of the Roundtable Report. That report outlined the responses of the Roundtable participants to the issues and their recommendations on future energy policy.

The energy strategy recommendations in this document have been derived from the previous two steps as well as internal analysis by the Department of Mines and Energy (now the Department of Natural Resources) and others. The recommended alternatives contained in this document are not "cast in stone" but will be subject to debate and the following consultative process.

1. This strategy has been placed before the Executive Council for their consideration and comment. Following approval the document is being released to the public for review and comment.

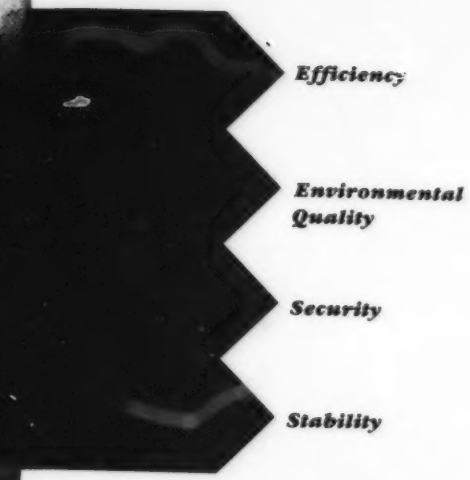
2. The Department of Natural Resources will begin meeting with interested stakeholder groups, at their request, to discuss the proposed strategy following its release.

3. The Department will issue separate policy papers on energy efficiency and conservation, coal, alternative energy, electricity, and oil and natural gas outlining the specific steps that will be taken to implement the elements of the strategy. Opportunities for public comment will be provided during this stage.

4. The Department will undertake periodic reviews of the current strategy and produce long-term forecasts of expected energy supply and demand trends. Strategy revisions, as appropriate, will be made only following opportunity for public input.

Implicit in this process is the need to ensure that this energy strategy and subsequent energy policy papers are consistent with the province's strategy in other areas including the economic strategy, the strategy on global warming, and the recommendations of the Roundtable on Environment and Economy, among others.

7 Conclusion



This document began with an explanation of why Nova Scotia's *Energy Plan 1985* needed to be updated. Clearly much has changed on the energy scene in the last five or six years: concern has grown about the impact of energy production and use on our environment, oil prices have been highly volatile, Nova Scotia's primary energy use has grown by more than 7 per cent, and we, and North Americans generally, are much more dependent on foreign oil. Nova Scotia finds itself today in a situation quite different from most other Canadian provinces. We do not have natural gas, nuclear power, or significant hydroelectric power readily available to us; we rely on Nova Scotia coal to generate most of our electricity; and we depend on imported oil for two-thirds of our total energy supply. In the next 10 years, we expect primary energy demand to grow by 2.3 per cent per year unless steps are taken to curb that demand growth.

It is time for the Nova Scotia government to update Nova Scotia's energy strategy and, most important, to involve the general public, the business community, the energy industry, and our energy regulatory bodies in the process. That was why the process began with the circulation of an energy discussion document setting out the energy issues we face and continued with a most valuable Energy Strategy Roundtable at which a wide range of Nova Scotians gave their views. This strategy summarizes the conclusions to date, but is by no means the last word on the subject. Throughout 1991 and beyond, the discussion, implementation, monitoring, and amendment process must and will continue as the energy picture changes.

The province has adopted *sustainable development*, that is, "meeting our present needs in ways that don't damage the environment or endanger the future," as a goal. Through the Nova Scotia Roundtable on Environment and Economy a strategy is being developed to set priorities and design actions to achieve this goal. This energy strategy has been formulated to be consistent with the overriding commitment to sustainable development. There are four main goals for Nova Scotia's energy strategy:

- Maximum, cost-effective efficiency in producing, and particularly using, our energy resources
- Notwithstanding our energy needs, maintenance, and, if possible, improvement of the quality of our environment
- Secure, long-term energy supplies
- Stable energy prices at affordable levels over the long term.

Before developing the strategy in detail, nine policy guidelines, listed in Chapter 3, were adopted. The linkage between energy and the environment features prominently in these guidelines. It was also acknowledged that there are many energy parameters, such as world oil prices, over which we have little control.

Thus the strategy itself was developed and five policy areas were examined: energy efficiency and conservation, electricity, coal, alternative energy, and oil and gas.

Specific recommended strategy elements are listed for each of these areas, but clearly, coordinated action on all five policy "fronts" will be required if the energy challenges of the next 10 years are to be met successfully. No one set of initiatives, even that for energy efficiency and conservation which everyone supports, will be enough on its own to constrain the forecast increases in energy demand and alter the energy supply mix. Seven features have been identified, several of which are common to more than one policy area. These are:

1. **Use of energy conservation and efficiency techniques.** Reducing energy demand will also reduce negative environmental impacts. Various technologies and practices, which are justifiable on the basis of energy cost savings alone, are readily available.

2. **Diversification of supply sources.** Diversifying supply sources will increase the province's flexibility, energy price stability, and security of supply. Diversity includes developing new sources of conventional fuels such as oil, gas, and coal as well as using alternative fuels (wood, passive solar, small hydro, etc.).

3. **Use of indigenous resources.** Using Nova Scotia resources will enhance security of supply, lower dependence on expensive imported fuels, and contribute to diversity. Indigenous resources include coal, wood, offshore oil and gas, wind, solar energy, hydroelectricity, tidal power, and geothermal energy.

4. **Environmental responsibility in all energy developments.** Such activities include the use of new technologies, comprehensive environmental reviews, and development of targets and standards to ensure that energy use and production are carried out in a manner that is consistent with our environmental objectives.

5. **Revisions to acts, regulations, and the regulatory system.** A review of existing rules and controls will improve the system and encourage public participation in the regulatory process.

6. **Development and use of new technologies.** New technologies will be introduced where appropriate, and research, development, and demonstration will be supported, when prudent.

7. **Improved communication with the public.** Behind each of these strategy elements, one common element is implicit: information. An informed public is essential if the strategies outlined in this document are to be successfully implemented.

Clearly, documenting the strategy achieves very little unless all energy stakeholders—the general public, business, the energy industry, government, and regulators—act as partners in implementing the strategy. The implementation process is an ongoing one and our energy targets will change with changing circumstances. However, we now have an updated game plan. As partners, we can make it work.

Appendices

Appendix A

Historical Energy Demand

End-use energy demand since 1979 has declined substantially. From 198.7 trillion Btu (TBtu) in 1979, demand has fallen to 161.8 TBtu in 1989. Most of the reduction occurred during the 1979 to 1984 period when oil prices rose sharply and the world economy was in recession. Demand was also affected by increased energy efficiency across all sectors during the period.

By fuel, coal has declined from 8.8 per cent of end-use demand in 1979 to just over 1 per cent in 1989. Closure of the Sydney Steel Corporation blast furnaces and coke ovens accounted for the majority of this decline.

Electricity demand has risen from 10.5 per cent of total end-use energy to just below 18 per cent in 1989. The total increase of 8.1 TBtu over this period occurred in the space heating, lighting, and appliance loads in the residential (5.3 TBtu) and commercial (2.8 TBtu) sectors.

Steam demand has fallen to zero from 8.4 per cent of demand in 1979. Closure of the two heavy water plants in Cape Breton accounted for this decrease.

Wood demand has increased substantially from 2.5 per cent of demand to 6.7 per cent. Incremental demand for wood waste in the pulp and paper and other industries as well as for roundwood for space heating fuel in the residential sector were the primary causes of this increase.

Demand for oil products declined over the 1979–1984 period and recovered slightly through the 1985–1989 period. Decreases in demand occurred over all sectors except the commercial sector. They resulted primarily from relatively high oil prices, federal off-oil programs, and concerted conservation efforts aimed at oil use. Reduced consumption also resulted from several major plant closures. Despite the decline in demand for oil, its market share grew from 69.8

Table A-1

Nova Scotia End-Use Energy Demand, 1979,1984, and 1989[1] (Trillions of Btu)

Consuming Sector	1979	1984	A.A.%* Change 1979-84	1989	A.A.%* Change 1984-89
Industrial					
Coal/coke/oven gas	16.3	4.6	(22.4)	0.8	(26.0)
Electricity	8.8	8.5	(0.7)	8.7	0.5
Steam	16.4	7.8	(13.8)	0.0	N/A
Wood	2.1	4.4	15.9	4.8	1.8
Oil	20.9	16.9	(4.2)	11.6	(7.2)
Total	64.5	42.2	(8.1)	25.9	(9.3)
Commercial/Public Administration					
Coal	0.0	0.1	N/A	0.0	N/A
Electricity	5.8	6.5	2.3	8.6	5.8
Steam	0.2	0.3	8.4	0.0	N/A
Wood	0.0	0.0	N/A	0.1	N/A
Oil	17.9	20.7	2.9	19.6	(1.1)
Total	23.9	27.6	2.9	28.3	0.5
Transportation					
Oil	68.3	57.6	(3.4)	63.6	2.0
Residential					
Coal	1.2	1.4	3.1	1.1	(4.7)
Electricity	6.3	7.7	4.1	11.6	8.5
Wood	2.8	5.8	15.7	6.0	0.7
Oil	31.7	22.2	(6.9)	25.3	2.6
Total	42.0	37.1	(2.5)	44.0	3.5
Total					
Coal/coke/oven gas	17.5	6.1	(19.0)	1.9	(20.8)
Electricity	20.9	22.7	1.7	28.9	4.9
Steam	16.6	8.1	(13.4)	0.0	N/A
Wood	4.9	10.2	15.8	10.9	1.3
Oil	138.8	117.4	(3.3)	120.1	0.5
Total	198.7	164.5	(3.7)	161.8	(0.3)
Total by Percentage					
Coal/coke/oven gas	8.8	3.7		1.2	
Electricity	10.5	13.8		17.9	
Steam	8.4	4.9		0.0	
Wood	2.5	6.2		6.7	
Oil	69.8	71.4		74.2	
Total	**100.0**	**100.0**		**100.0**	

* Average annual percentage change.

per cent of total end-use demand in 1979 to over 74 per cent in 1989 as demand for total remaining energy sources fell at even greater rates.

Demand for primary energy in Nova Scotia declined substantially over the 1979–1984 period, reflecting the accompanying reduction in end-use demand. Demand has recovered slightly over the 1985–1989 period.

Coal demand has risen sharply since 1979. This was caused by the incremental coal required to supply coal-fired electricity generating plants brought on stream over the 1979–1984 period. Slight reduction in primary coal demand since then reflects the relative attractiveness of oil as a generating fuel following the large price decreases in 1986.

Hydroelectricity production has declined from the abnormally high level of 15.2 TBtu in 1979 owing to variations in water availability to the Nova Scotia Power Corporation system and a fall in net receipts of power from New Brunswick.

Wood fuel demand has risen as outlined in the end-use description. End-use and primary wood consumption are identical in value, as wood is not converted to any other fuel form in the province before being consumed.

Requirements for crude oil decreased over the 1979-1984 period, reflecting the decline in demand for oil products caused by relatively high prices and the decline in economic activity. Demand has rebounded slightly since then, particularly following the decline in oil prices in 1986.

Notes

1. End-use energy demand accounts for the energy consumed in its final form by the consumer, such as electricity or coal used directly for heating purposes by a home owner or industry. Primary energy demand consists of all energy used, including energy consumed in the conversion of primary energy to end use energy forms. (For example, coal, a primary energy resource, may be used to generate "end-use" electricity; crude oil is a primary resource refined to produce "end-use" petroleum products.) During the conversion process a portion of the energy contained in the primary resource is released to the environment or essentially lost for practical purposes.

Table A-2

Nova Scotia Primary Energy Demand, 1979,1984, and 1989 (Trillions of Btu)

Fuel	1979	1984	AA%* Change 1979-84	1989	AA%* Change 1984-89
Coal	42.9	61.7	7.5	59.6	(0.7)
Hydroelectricity	15.2	10.7	(6.8)	10.4	(0.6)
Wood	4.9	10.2	15.8	10.9	1.3
Oil	213.9	150.3	(6.8)	167.6	2.2
Total	**276.9**	**232.9**	**(3.4)**	**248.5**	**1.3**

* Average annual percentage change.

Table A-3

Nova Scotia Primary Energy Demand, 1979,1984, and 1989 (% of Total)

Fuel	1979	1984	1989
Coal	15.5	26.5	24.0
Hydroelectricity	5.5	4.6	4.2
Wood	1.8	4.4	4.4
Oil	77.2	64.5	67.4
Total	**100.0**	**100.0**	**100.0**

Appendix B

Nova Scotia Energy Resources

This appendix provides an overview of the potential for energy efficiency and conservation in Nova Scotia, background on the ways in which we produce electricity, and a review of the province's major indigenous energy resources: coal, wood, and petroleum.

Nova Scotia does possess other forms or potential forms of energy such as peat, municipal solid waste, wind, solar power, and agricultural wastes. None of these, however, is available in sufficient amounts to make a large contribution to our primary energy requirements.

Energy Efficiency and Conservation

Opportunities for improving the efficiency of energy use in Nova Scotia are substantial, cut across all sectors, and involve an array of fuels and measures. In the 1985 *Energy Plan for Nova Scotia*, estimates of the cost-effective potential for reduced provincial energy use ranged from a high of 29 per cent for the residential sector to a low of 10 per cent for the transportation sector.

National estimates of potential savings in various sectors are available from several sources. A report prepared in 1989 for the Provincial, Territorial and Federal Energy Ministers' Task force on Energy and the Environment calculated the *technical* (as opposed to economic) potential for energy reductions using currently available technology. For most sectors, potential reductions of about 30 per cent were estimated.

A 1987 report by Energy, Mines and Resources Canada (EMR) presented estimates of potential savings based on low world oil prices. Savings were estimated to be in the 15 to 22 per cent range for all sectors except transportation, where no estimate was given.

The following table summarizes by sector realistic and significant measures that can be taken:

Table B-1

Energy Efficiency and Conservation Measures

Sector	Measures
Residential	• high efficiency water heaters • low flow shower heads • heating system improvements • pipe and duct insulation • building envelope insulation • more efficient lighting • air sealing • improved window performance • more efficient appliances

Industrial	• improved processing systems • variable speed drives • microprocessor controls • lighting improvements • high efficiency motors • heat pumps • ventilation system improvements • cogeneration • electrotechnologies that improve process control and reduce energy use
Institutional/Commercial	• heat pumps • refrigeration improvements • more efficient lighting • building management systems • energy-efficient motors • ventilation system improvements • improved thermal performance
Transportation	• fuel-efficient new vehicles • new engine technologies • improved aerodynamics • improved maintenance • life cycle costing of road routing for private and public costs • traffic control systems • mass transit

Table B-2

Nova Scotia Electric Generating Capacity, 1989

	Units	Capacity (MW)	% of Capacity
NSPC			
Hydro	54	381.4	18.9
Thermal	25	1582.6	78.3
Wind	1	0.3	0.0
Total	80	1964.3	97.2
Private			
Hydro	2	5.0	0.2
Thermal	5	52.1	2.6
Total	7	57.1	2.8
Grand Total	**87**	**2021.4**	**100.0**

Table B-3

Net Electricity Supply in Nova Scotia, 1989 (Preliminary)

Source	Generation (GWh)	% of Generation
NSPC Generation		
Thermal		
Coal	5482	59.1
Oil	2462	26.6
Hydro		
River	902	9.7
Tidal	26	0.3
Total	8872	95.7
Private Generation		
Thermal	259	2.8
Hydro	37	0.4
Total	296	3.2
Net Imports	100	1.1
Total	**9268**	**100.0**

Electricity

In 1989, Nova Scotia had 2021.4 megawatts (MW) of electric generating capacity (see Table B-2). This figure, and those that follow, refer to units owned by companies with generating systems with a capacity greater than 0.5 MW. A number of smaller privately owned hydro and wind units exist in various areas of the province.

The Nova Scotia Power Corporation (NSPC) owns roughly 97 per cent of this capacity. Thermal facilities accounted for 80.9 per cent of capacity, hydro provided 19.1 per cent, and wind a negligible amount.

In terms of actual generation, these facilities produced 9168 gigawatt hours (GWh) of electricity with net imports from New Brunswick supplying an additional 100 GWh (See Table B-3).

Base load electricity supply is expected to be derived primarily from coal-fired units over the next 10 years. The remaining developable hydro sites in the province are only capable of supplying 1 per cent of the present electricity demand. Neither nuclear nor tidal power could be brought on-line within a 10-year time frame. Natural gas either from western Canada or offshore Nova Scotia will probably not be available until near the end of the decade at the earliest, given the long lead times required for pipeline construction or offshore development. Large amounts of imported electricity from provinces such as New Brunswick and Quebec are not expected to be available within the next 10 years, since, without the addition of new generating facilities, these provinces lack surplus capacity.

The Nova Scotia Power Corporation operates the only tidal power station in North America. This station, located at Annapolis Royal, is rated at 19.5 MW capacity. It produces sufficient energy to supply 10,000 people with electricity (about 26,000 MWh per year).

Once analysis of this prototype plant and its environmental impact are completed, development could take place at several sites, the most likely of which are named A8 (Chignecto Bay) and B9 (Cobequid Bay). The A8 site would have 37 generators with a capacity of 1428 MW and cost $3.4 billion (1990 dollars). B9 would have 128 generators with a capacity of 5338 MW and cost $10-14 billion (1990 dollars).

Aside from the potential uncertainties caused by the environmental impacts, sheer size, and cost of the project, the main barrier to the development of tidal power is that it produces energy in periods of a few hours on each tide. Generation does not necessarily coincide with peak load demand for electrical power. Indeed, because tides do not rise and fall at the same time each day, the two periods when tidal power would be available vary from day to day.

The solution to the timing problems may lie in a regional electric development project involving New Brunswick, Nova Scotia, Quebec, and New England. A market of this size could absorb the output of the tidal station without resulting in significant retiming requirements, particularly if hydroelectric capacity is timed to offset electrical output from tidal generating facilities.

The forecast electrical load for the year 2000 recognizes a continuing improvement in the efficiency of energy use, which results in reduction of some 30 MW in the forecast load. Non-firm load, which is a tangible demand side option that permits elimination of peaking capacity, is expected to rise from 100 MW in 1990 to 180 MW over the decade. This represents roughly 8 per cent of firm system peak and is one of the largest percentages of "interruptible" load of any jurisdiction in North America. Intensive NSPC demand side management studies indicate a potential package of programs that could cost-effectively reduce demand on the system by up to 200 MW over the next 10 years.

Coal

With discovered resources of 3.3 billion tonnes (see Table B-4) and recoverable reserves of one billion tonnes, coal remains the largest indigenous energy resource in Nova Scotia. Assuming historical annual production rates of approximately 4.5 million tonnes, the province's coal reserves will last more than 220 years. There are ample reserves to support increased production for either the domestic or export market.

Almost 90 per cent of these reserves are located in the Sydney Coalfield in Cape Breton.

Table B-4

Nova Scotia Coal Industry, 1989

	Quantity ('000 tonnes)
Discovered Resources	
Sydney Coalfield	2,919,000
Mabou Coalfield	160,000
Pictou Coalfield	148,000
Other	115,000
Total	**3,342,000**
Recoverable Resources	
Sydney Coalfield	937,000
Mabou Coalfield	52,000
Pictou Coalfield	26,000
Other	33,000
Total	**1,048,000**
Supply and Demand	
Raw coal production	3,381*
Inventory adjustment (waste etc.)	146
Imports	0
Total supply	**3,527**
NSPC Demand	2,108
Sectoral use	61
Exports	1,358
Total demand	**3,527**

* Production in 1989 was reduced from normal levels owing to a 2-1/2 month strike.

Production in 1989 came primarily from three mines owned by the Cape Breton Development Corporation (Lingan, Prince, and Phalen), which together produced almost 90 per cent of the raw coal output. The remainder came from six smaller mines and reclamation operations. Production of up to 1,000,000 tonnes per year will commence from the Westray Mine in the Pictou Coalfield in late 1991 to supply the Trenton generating station and other markets.

In 1989, roughly 60 per cent of coal production was consumed in Nova Scotia. Almost all of this (97 per cent) was used by the NSPC to generate electricity. Exports were destined primarily for Europe, Japan, and the United States.

Wood and Biomass

Forest biomass is generally defined as the total amount of wood fibre available from the forests, including the stump, stem, and branches. It is normally broken into two categories: merchantable wood and forest residue. Merchantable wood, which includes only the larger stems of the tree, is used both for commercial purposes (such as saw logs, pulp logs, etc.) and for heating in the form of roundwood or waste products from wood processing.

Forest residue is material with no commercial value, using conventional harvesting practices. It includes logging residue, silviculture thinnings, uncommercial species, diseased trees, and poor quality stands.

Current estimates indicate that the forests could yield up to 2.5 million green tonnes of wood on an annual basis for energy purposes as shown in Table B-5. This includes 1.835 million green tonnes of logging residue, silviculture thinnings, and the unused portion of the hardwood allowable cut as estimated by the Nova Scotia Department of Lands and Forests (now the Department of Natural Resources). It also includes 615,000 green tonnes of sawmill and pulp mill waste. This excludes the amount of roundwood cut for residential fuel by private landowners.

Table B-5

Annual Availability in Nova Scotia of Wood Biomass for Energy
('000 Green Tonnes)

Merchantable Wood	
Hardwood allowable cut	940
Pulp and sawmill waste	615
Residue	
Logging residue	615
Uneconomical stands and silviculture thinnings	280
Total	**2,450**

This total annual potential is equal to 21.6 trillion Btu or 3.7 million barrels of oil equivalent. This total resource is almost double current use of biomass of 10.9 trillion Btu. Ample capacity therefore exists to expand the consumption of wood for energy purposes.

The major barriers to the increased use of wood chips are the absence of a fuel supply infrastructure and the relatively high capital costs involved in installing fuel handling and combustion systems. Transportation and marketing require a coordinated approach, and this may create administrative difficulties because of the large number of small, privately owned woodlots involved. Finally, the environmental effects of removing forest residue must be given consideration, although recent studies suggest that problems in this area arise from the methods used and not from the amount harvested.

Oil and Natural Gas

Currently, Nova Scotia does not produce any oil or natural gas. We do however have the potential to become producers in the future.

To date more than 120 oil and gas exploration wells have been drilled off Nova Scotia. Approximately 100 more have been drilled onshore. These wells have resulted in 22 significant discoveries of oil and gas in the offshore region. Total discovered resources, as estimated by the Canada Oil and Gas Lands Administration (COGLA) are:

- 5.7 trillion cubic feet (tcf) of natural gas (1.0 billion barrels of oil equivalent)
- 144 million barrels of oil and condensate

COGLA estimates, given 50 per cent probability, the total recoverable gas resource for the entire offshore area of Nova Scotia to be 18.1 trillion cubic feet of gas (3.2 billion barrels of oil equivalent). The total oil and condensate resource under the same assumptions is estimated to be 1.1 billion barrels. To put this resource in perspective, Nova Scotia currently consumes approximately 28.5 million barrels of oil per year.

Oil production from the offshore is expected to begin in 1992. The Cohasset and Panuke oil fields are expected to yield about 35 million barrels of oil over six years. The project is being developed by LASMO Nova Scotia Limited and Nova Scotia Resources Limited, a provincial crown corporation. The oil will be produced using a production jack-up rig, two wellhead jackets, an on-site storage tanker, and a shuttle tanker to move the crude oil to market. Final destinations for the crude have not yet been determined. Further oil development projects must await additional discoveries and delineation.

Of the 5.7 tcf of natural gas reserves, 4.2 tcf are located within a 25-mile (40-km) radius of Sable Island. The concentration of reserves in such a small area will facilitate development of the resource. Further offshore oil and gas activity will take place in a climate of favourable long-term prices, regulatory stability, and an appropriate fiscal regime.

Coalbed Methane

Coal seams have been recognized as a source of natural gas since the early days of coal mining. Historically, mine operators have treated methane as a hazard to mining and have sought to remove and vent it. However, the gas is a potentially valuable fuel, and venting may contribute to the global warming problem. In the United States technological advances and federal tax credits have enabled coalbed methane to be produced commercially from two major coal basins.

Nova Scotia's coal basins are seen as similar sources of commercial reserves. If methane can be extracted ahead of coal mining and used as a fuel, safety, environmental, and resource management advantages result. The Department of Natural Resources is currently conducting an evaluation of the size of the coalbed methane reserves in each of the coal basins in the province. The study will also examine the commercial potential of these reserves.

Appendix C

Assumptions Supporting Base Case Energy Demand Forecast

The Nova Scotia Department of Natural Resources, as part of its ongoing planning functions, regularly prepares forecasts of future energy requirements in the province. These energy forecasts are prepared with the assistance of complex computer models, which are similar to demand models utilized by many other Canadian and American governments, utilities, and energy industries. The models incorporate data on demographics, energy commodity prices, the economy, historical energy use, and attitudinal factors.

The primary energy demand forecast in Table 3 (p. 5) is based on an end-use energy demand forecast. The end-use forecast takes into account estimates of energy efficiency improvements; however, the forecast assumes that there is only limited government intervention in the form of financial incentives or regulation. No government policy initiatives that would promote the use of one fuel or discourage the use of another fuel are considered in this forecast.

Population:	increases at an annual average rate of 0.4 per cent.
Households:	increase at an annual average rate of 1.4 per cent.
Total Real Domestic Provincial Product:	increases at an annual average rate of 1.9 per cent.
Industrial Real Domestic Product:	increases at an annual average rate of 1.6 per cent.
Crude Oil Prices:	increase at 2.3 per cent annually above the rate of inflation (in $Cdn.).
Other Energy Prices:	increase annually at the rate of inflation.
Inflation:	increases at 4.8 per cent per year.

Appendix D

Glossary

Base load generation capacity	Generating facilities within a utility system that have low operating costs and are therefore run as much as possible, in order to minimize system operating costs. Except for maintenance periods, base load generation is usually run all the time.
Biomass	Unfossilized organic matter used to produce energy including wood, crop waste, municipal solid wastes, and sawmill waste.
British thermal unit (Btu)	The amount of heat that must be added to one pound of water to raise the temperature by 1° Fahrenheit under stated conditions of temperature and pressure.
Commercial sector	One of the four sectors normally used to describe aggregated groups of end-use energy consumers. This sector includes office buildings, schools, universities, hospitals, stores, shopping centres, banks, hotels, motels, restaurants, and government operations.
Conversion losses	The loss in the energy content of various energy forms when they are transformed from one form to another form. For example, when coal or petroleum products are used to generate electricity, the energy content of the coal or petroleum products used exceeds the energy content of the electricity produced. The difference is the conversion loss.
Cost effective	A measure of the financial viability of the implementation of a specific change.
Demand-side management	Actions taken by a utility or other agency intended to influence the amount or timing of customers' use of electricity.
End-use energy demand	Total demand for energy products for final use as energy in the final consuming sectors (residential, transportation, commercial, and industrial). Conversion losses are not included in end-use energy demand.
Greenhouse gases	Certain gases, including carbon dioxide, CFCs, nitrous oxide, and methane, accumulate in the earth's atmosphere. These gases absorb light, which traps heat in the atmosphere, and are believed to be contributors to global warming.
Industrial sector	One of the four sectors normally used to describe aggregated groups of end-use energy consumers. Activities categorized in this sector include mining, manufacturing, forestry, fishing, hunting and trapping, agriculture, and construction.
Joule (J)	Equivalent to 0.230 calories, where 1 calorie is the amount of heat required to raise the temperature of 1 gram of water from 14.5° Celsius to 15.5° Celsius under 1 atmosphere of pressure.
Megawatt (MW)	One thousand kilowatts.
Primary energy demand	The total demand for energy products in the economy prior to any conversions to other energy sources. Primary energy demand includes the demand for crude oil, coal, natural gas, wood, and electricity generated from hydro sites, nuclear, or geothermal sources. Conversion losses are not included.
Residential sector	One of the four sectors normally used to describe aggregated groups of end-use energy consumers. Energy use reported in this sector includes energy used in all types of housing and household energy use on farms.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Transportation sector	One of the four sectors normally used to describe aggregated groups of end-use energy consumers. This sector includes all road, rail, marine, air, and railway use for transportation purposes.

Appendix E

Approximate Energy Conversion Factors

Energy Type	Imperial Unit	Energy Content (million Btu)
Coal—imported bituminous	1 short ton	24.95
Coal—N.S. bituminous	1 short ton	24.52
Coke	1 short ton	24.80
Crude oil	1 barrel	5.803
Diesel fuel oil	1 gallon	0.17
Electricity (end use)	1,000 kwh	3.412
Electricity (primary)*	1,000 kwh	10.0
Heavy fuel oil	1 barrel	6.287
Kerosene	1 gallon	0.18
Light fuel oil	1 gallon	0.17
Motor gasoline	1 gallon	0.15
Natural gas	1,000 cubic feet	1.015
Propane	1 gallon	0.11
Solid wood wastes (bone dry)	1 short ton	15.48

Energy Type	Metric Unit	Energy Content (Gigajoules)
Coal—imported bituminous	1 metric tonne	29.0
Coal—N.S. bituminous	1 metric tonne	28.5
Coke	1 metric tonne	28.83
Crude oil	1 cubic metre	38.51
Diesel fuel oil	1,000 litres	38.67
Electricity (end use)	1,000 kwh	3.6
Electricity (primary)*	1,000 kwh	10.5
Heavy fuel oil	1 cubic metre	41.73
Kerosene	1,000 litres	37.68
Light fuel oil	1,000 litres	38.67
Motor gasoline	1,000 litres	34.66
Natural gas	1,000 cubic metres	37.78
Propane	1,000 litres	41.73
Solid wood wastes (bone dry)	1 metric tonne	18.0

Approximate Unit Conversions

Metric	Imperial
1 cubic metre (gas)	35.3 cubic feet
1 cubic metre (liquid)	6.29 barrels
1,000 litres	6.29 barrels
1 litre	0.22 gallon
1,000 joules	0.95 Btu
1 metric tonne	1.1 short tons

*Primary electricity is that produced from hydro, nuclear, or geothermal.